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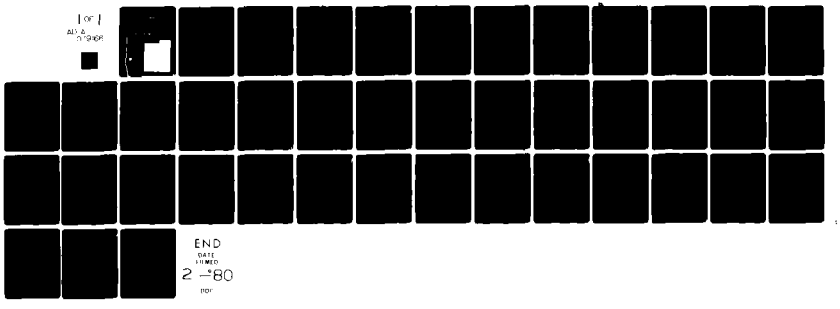
SURVEY OF U.S. ARMY MONITOR JOBS,(U)
APR 62 D A DOBBINS , D M SKORDAHL
UNCLASSIFIED APRO-RESEARCH STUDY-62-1 NL



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RESEARCH STUDY 62-1

Survey of US Army Monitor Jobs

USAPRO

U. S. ARMY
PERSONNEL
RESEARCH
OFFICE

Army Project Number
OJ 95-60-001

Error-Free Performance d-01

Research Study 62-1

(6) SURVEY OF U. S. ARMY MONITOR JOBS,

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(14) APRO—RESEARCH ARMY—62-1

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PREFACE

The present research study reports on a portion of Subtask d, Experimental Laboratory Studies of Vigilance Behavior, of the ERROR-FREE PERFORMANCE Task, FY 62 Work Program. (For FY 63, this Task will be renamed "Dependable Performance in Monitor Jobs"--MONITOR PERFORMANCE.) The entire research task furthers the U. S. Army Military Personnel Management (DCSPER) objective of developing and making available for operational use research products to optimize the selection, classification, assignment, and utilization of Army personnel. Problem areas of interest to the Army Security Agency are also being studied under this Task.

Advances in military technology require a high degree of dependability in the various man-machine complexes. Human performance is generally more variable than are the machine components of the system. Hence human performance in the more critical jobs represents a significant determinant of the overall reliability of any weapons or communications system. Decrement in or errors of performance occur as a result of various internal factors such as fatigue, boredom, poor morale, and anxiety. Decrement in or errors of performance also occur as a result of various external factors such as emergency pressures, isolation, weather extremes, methods of supervision, and other working conditions.

The primary objective of the MONITOR PERFORMANCE Task, as with the predecessor ERROR-FREE PERFORMANCE Task, is to minimize the incidence of human error in critical assignments and to develop means of inhibiting decline in critical performance. The research is designed to lead to improved selection and assignment of personnel in jobs of which the sustained ability to detect and respond to critical signals is an important component, and to improved utilization of personnel in those jobs through identification of the psychological factors involved and through optimum work methods.

BRIEF

SURVEY OF U. S. ARMY MONITOR JOBS

REQUIREMENT:

The complex weapons and surveillance systems of the modern Army have created a relatively new series of jobs requiring a high degree of alertness and dependability. Initial planning of a long-range USAPRO research effort in the area of vigilance has required a review of the extensive body of experimental vigilance research plus a survey of Army jobs possessing a vigilance component. The present survey was concerned with three aspects of Army monitor jobs: number, types, and distribution of duty positions; major characteristics of Army monitor jobs; and relative importance of monitor jobs in achieving unit missions.

PROCEDURE:

Questionnaires were devised and sent to various elements of the combat arms and the technical services requesting information about non-classified duty positions which are potentially vigilance-type positions. 1528 duty positions were so examined by respondents.

FINDINGS:

1. 102 duty positions were designated by operational personnel as having sufficiently heavy proportions of monitoring duties to be designated as vigilance jobs: 72 in the combat arms and 30 in the technical services.

2. Monitor jobs predominantly involved equipment monitoring (usually instrument panels), visual rather than auditory monitoring, uncontrollable signal rates rather than self-paced situations. Other characteristics of monitor jobs concerned length of work period, frequency and duration of rest periods, proportion of monitoring to non-monitoring time, accuracy checks, and annoying human factors problems reported.

3. 84 percent of the monitor jobs were rated as critically or extremely important to the achievement of unit missions.

UTILIZATION OF FINDINGS:

The current prevalence of Army monitor jobs and likelihood of increase of such jobs in the future, amenability of characteristics of monitor jobs to a human factors research approach, and high degree of importance attached to monitor jobs are all factors viewed as justifying a long-range research program in monitor problems and indicating some of the research directions to be followed in such a program.

SURVEY OF U. S. ARMY MONITOR JOBS

NEED FOR A SURVEY

The complex weapons and surveillance systems of the modern Army have created a relatively new series of jobs requiring a high degree of alertness and dependability. These jobs are found in closed circuit television of fixed and mobile facilities, in weapons systems incorporating instrument panels of varying degrees of complexity, in systems requiring the scanning and receiving of many types of electronically emitted signals, and in the many new systems using radar surveillance.

The operator's ability to remain alert and to continue to respond is often a critical factor in the successful operation of these systems. Operators must rapidly detect and identify a variety of visual and auditory signals which occur unpredictably and which are often embedded in a background of distracting sights and sounds. Whether the responses required are simple or fairly complex, operators must continue to respond accurately and quickly even when required to work long hours under arduous, fatiguing, or boresome conditions. When observers are required to respond to visual or auditory signals that appear infrequently, irregularly, weakly, or briefly, an increasingly lower percentage of signals is detected as the vigil progresses. More than 25 investigators, working independently, have reported significant vigilance performance decrements under specified conditions (Baker, 1959).

Duties and missions found among the Army's monitor jobs vary widely. Most research efforts in the field of vigilance have centered on problems of radarscope monitoring and have used actual or simulated radarscopes as experimental displays. Relatively little attention has been given to vigilance problems associated with the monitoring of multiple-source displays such as instrument panels, and with free-search monitoring as performed by terrain observers and lookouts.

All Army vigilance-type jobs make one critical and uniform requirement upon the incumbent: he must observe, to some degree, an instrument configuration or a sector of terrain in order to extract signals that appear unpredictably. In view of this common requirement, problems involving alertness decrements may well be characteristic of all types of monitor job, including the monitoring of instrument panels and free search. It was the purpose of the survey described in this research study to obtain a comprehensive view of present Army monitor or vigilance positions. Such information was to be merged with findings from a review of previous experimental research to form the basis for planning the long-range U. S. Army Personnel Research Office vigilance research program.

OBJECTIVES OF THE SURVEY

The survey had the following objectives:

1. To determine number, types, and distribution of Army enlisted jobs and duty positions in which monitor activity is a significant component.

2. To determine types of job duties that monitors are called upon to perform, and to classify the positions with respect to such characteristics as

   a. type of signal display monitored

   b. pattern of signal occurrence

   c. primary sense modality used in monitoring

   d. characteristics of the working environment

   e. accuracy checks used in the monitor system

3. To determine relative importance of each monitor job in achieving unit mission.

A determination of the prevalence and importance of Army monitor jobs was considered a necessary aid in defining the scope of the research effort. Information as to characteristics of monitor jobs was considered essential for guiding the content and direction of the actual research.

SURVEY PROCEDURE

GENERAL PLAN

Questionnaires were sent to various elements of the combat arms and the technical services requesting information about nonclassified duty positions (4-digit MOS) which were potentially vigilance-type jobs. In all, 1528 such positions were included in the lists mailed to questionnaire respondents. This preliminary compilation was based on AR 611-201, Manual of Enlisted Military Occupational Specialties. Duty positions that were obviously non-monitoring positions, such as administrative and clerical positions, were excluded from consideration.

Questionnaires were mailed to the following Technical Services officials: Chief Chemical Officer, Chief Signal Officer, Chief of Engineers, The Quartermaster General, The Surgeon General, and the Chief of Transportation. Information was obtained directly through personal contact from representatives of

the Chief of Ordnance. Questionnaires were mailed through USCONARC to Armor, Air Defense, Artillery, and Infantry. Within each of these arms, questionnaires were disseminated by USCONARC through headquarters elements to persons with the requisite job knowledge who were located either in operational units or in training schools.

QUESTIONNAIRE CONTENT

Each questionnaire package consisted of the following three inclosures:

1. List of duty positions potentially requiring vigilance.

2. Questionnaire form to be completed for each duty position judged by the respondent to be a monitor job (Appendix A). The questionnaire consisted of 22 items, 11 of which allowed an open-ended response. Some questionnaire items were designed to elicit information about monitoring variables known through past research to have a significant influence on vigilance performance--signal rate, signal regularity, duration of signal, length of vigil, pacing of the task, and concurrent non-monitor tasks. Other questionnaire items were designed to gather information concerning aspects of the Army setting which operators and supervisors considered troublesome, such as particularly annoying conditions of the work environment or problems anticipated in connection with changes in monitor jobs under combat conditions. Finally, two items were included for the purpose of developing an index to the importance of a given vigilance position. One such item required a description of the consequences of poor monitoring performance. Another required a rating of job importance on a four-point scale of criticality.

3. Booklet of Instructions for Completing Questionnaires (Appendix B). First, vigilance was defined for respondents as "the process of paying sustained attention to some task over a relatively prolonged period of time. Typically, the observer is confronted with a series of signals (visual or auditory) to which he must pay attention in order to detect a particular type or class of signal. The signals requiring the observer to respond are called critical signals..."

Second, examples of four vigilance jobs were given: radar monitoring, communications (auditory) monitoring, inspection, and free search monitoring.

Third, criteria for identifying vigilance jobs were furnished: (1) The job had to require a minimum of 30 minutes of continuous observation. The selection of 30 minutes was not an arbitrary one; laboratory research has generally shown that the steepest decrement in performance occurs within the first 30 minutes of monitoring. (2) The job had to require the observer to differentiate certain critical signals from competing, irrelevant, or background non-critical signals. (3) Critical signals were not limited to electronic emissions; they could include, for example, personnel, vehicles, weapon flashes, and terrain features. (4) The job could require concomitant non-monitor tasks and still be considered a vigilance job, since most jobs require interpolated or parallel non-monitor duties. These non-monitor duties are hypothesized to influence or interact with detection performance, even though little research information is available on the subject.

Questionnaire respondents were asked to study the list of job positions first and then to select from the large list only those jobs meeting the criteria for monitor jobs set forth in the preceding paragraph. For each job so selected, respondents were next asked to complete and return one questionnaire.

QUESTIONNAIRE RETURNS

Eighty-eight completed questionnaires were returned. Of these, seven were considered invalid because of seriously incomplete information or because instructions had not been adequately followed. The total number of duty positions designated as monitor jobs in the remaining 81 questionnaires was 102. There were 14 more duty positions than questionnaires because in several cases two or more duty positions were covered in a single questionnaire.

The 102 jobs identified is probably a conservative estimate of the total number of Army monitor jobs. AR 611-201 shows the following jobs which were not designated as vigilance jobs by questionnaire respondents: Target Airplane crewman, 105.7; Field Artillery Intelligence observer, 140.0; Power Station operators, 345.1; various vehicle drivers, 640 and 642; and Air Traffic controller, 901. Information available in the form of job descriptions indicates that these jobs may well include monitor duties.

Conclusions drawn in the present study are based wholly on information contained in the 81 valid questionnaires returned. The survey did not attempt a detailed evaluation of Army vigilance requirements, but rather a global estimate of how many vigilance jobs are now in existence, where they are located, what they are like, and how important they are considered to be.

NUMBER AND DISTRIBUTION OF MONITOR JOBS

The 102 duty positions designated as monitor jobs by respondents accounted for all or part of 57 three-digit Military Occupational Specialties. However, the total included 10 duplications, since some MOS are monitored by more than one service. Thus, 47 distinct MOS were considered to have one or more duty positions in which vigilance is a component (Table 1).

The density of monitor jobs was relatively greater in the Combat Arms than in the Technical Services. The Combat Arms reported 72 monitor positions from a total of 385 surveyed; the Technical Services reported only 30 out of 1,143 surveyed. Monitor jobs were fairly evenly distributed within elements of the Combat Arms. Within the Technical Services, however, only the Corps of Engineers, Transportation Corps, and The Quartermaster General reported substantial numbers of monitor jobs--12, 8, and 7, respectively. The Chemical Corps, Signal Corps, and The Surgeon General each reported only one job. The Ordnance Corps reported no monitor jobs. Ordnance Corps personnel explained

that most of the equipment used was test equipment which did not require lengthy or continuous observation.

Table 1

DISTRIBUTION OF DUTY POSITIONS AND MOS IDENTIFIED IN QUESTIONNAIRE RETURNS AS HAVING A SUBSTANTIAL MONITOR COMPONENT

Service Elements	Number of Duty Positions Surveyed	Number of Monitor Jobs	
		4-Digit MOS	3-Digit MOS
COMBAT ARMS			
Air Defense	101	21	15
Armor	51	19	10
Field Artillery	135	14	10
Infantry	98	18	6
	385	72	41
TECHNICAL SERVICES			
Chemical Corps	45	1	1
Corps of Engineers	255	12	7
Ordnance Corps	357	0	0
Quartermaster General	62	7	2
Signal Corps	205	1	1
Surgeon General	62	1	1
Transportation Corps	157	8	4
	1,143	30	16
Total	1,528	102[a]	57[b]

[a] 81 questionnaires were completed covering 102 duty positions. Some questionnaires applied to more than one duty position.

[b] This total includes 10 duplications since some MOS occur in more than one Technical Service. Thus, 47 distinct MOS were identified.

Table 2 classifies the monitor positions by general type of monitoring required--radar, terrain, equipment--and relates the categories to the various service elements. Radar monitor positions include those jobs in which the primary task is the scanning of various types of radarscopes. Included in the terrain monitor category are those positions involving primarily the scanning of terrain for various "signals", such as aggressor personnel and equipment. The equipment monitor category included a heterogeneous collection of positions involving observation of instrument panels, test instruments, situational plots, laboratory apparatus, and equipment

items to be inspected. Distinctions between radar and equipment categories were difficult to make on the basis of some questionnaires, and some jobs may have been misclassified as a consequence. The specific duty positions classified under each category are listed in Appendix C. All radar and terrain monitor jobs were found in the Combat Arms: Air Defense was responsible for most radar monitor jobs and the Infantry for half of all terrain monitor jobs. Equipment monitoring accounted for nearly two-thirds of all monitor positions; the jobs were fairly evenly divided between the Combat Arms and Technical Services. Because of qualitative differences among radar, terrain, and equipment monitoring activity, the distinctions were maintained in preparing many of the subsequent tables.

Table 2

DISTRIBUTION OF DUTY POSITIONS IDENTIFIED AS MONITOR JOBS BY SERVICE AND TYPE OF MONITORING

Service Elements	Radar Monitoring	Terrain Monitoring	Equipment Monitoring	Total
COMBAT ARMS				
Air Defense	12	0	9	21
Armor	2	6	11	19
Field Artillery	2	5	7	14
Infantry	0	11	7	18
	16	22	34	72
TECHNICAL SERVICES				
Chemical Corps	0	0	1	1
Corps of Engineers	0	0	12	12
Ordnance Corps	0	0	0	0
Quartermaster General	0	0	7	7
Signal Corps	0	0	1	1
Surgeon General	0	0	1	1
Transportation Corps	0	0	8	8
	0	0	30	30
Total	16	22	64	102

IMPORTANCE OF MONITOR JOBS TO THE ARMY

A critical question--from the standpoint of the scope of a research effort--is the degree of importance attached to monitor jobs. Questionnaire respondents were furnished a four-point graphic rating scale and asked to rate the criticality of each monitor job with respect to achieving the mission of the immediate military unit. Results of these ratings are shown in Table 3. Over-all, 84 percent of all jobs included in questionnaire returns were rated as either "extremely" or "critically" important to the attainment of unit missions; 44 percent were given the highest rating--"critically important." Only 16 percent were rated "fairly" or "very" important. Terrain monitor jobs were rated lower than other types of monitor job; the lower rating seems appropriate inasmuch as responsibility is often spread among many monitors in the field combat setting.

An indirect but more convincing index of job importance is the potential consequence of poor performance in the monitor jobs. Respondents were asked simply: "What happens when the monitor fails to detect a critical signal?" The most frequently noted consequence was "Delay or malfunction in launching missiles"--reported 22 times, 14 times for Combat Arms equipment monitors and 8 times for radar monitors (Table 4). "Personnel or equipment loss or damage, not as a result of enemy action" was reported frequently but only for Technical Services equipment monitors. The third most frequent category was "Delay or breakdown in communications and intelligence." This response was reported primarily for Combat Arms equipment monitors. "Potential destruction or forced retreat of U. S. Army tactical units" was the fourth most frequent category and was reported exclusively for Combat Arms terrain monitors. Other consequences listed: "Delays in the detection of enemy aircraft or missiles," "Inaccurate placement of heavy weapons fire," "Delays in locating and firing on enemy emplacements," and "Possible destruction of heavy artillery or armor."

CHARACTERISTICS OF MONITOR JOBS

SOURCE OF MONITORED SIGNALS

One questionnaire item called for a brief description of the object, scene, or apparatus monitored in a given job. Table 5 summarizes responses to this question. Activity involving an instrument panel of some type (excluding radar) accounted for the monitoring component of 31 of the 81 jobs identified. Both radarscope monitoring and terrain monitoring positions included jobs in which the observers did one type of monitoring exclusively and jobs in which allied displays and equipment were also observed.

Only six of the 81 questionnaires, representing nine duty positions, reflected strictly auditory vigilance tasks, all others were primarily visual tasks (Appendix C).

Table 3

RATED IMPORTANCE OF MONITOR JOBS IN ACHIEVING IMMEDIATE UNIT MISSIONS

Rating Scale	Frequency of Responses				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
1. Fairly Important. Failure to do this job properly might slow down or hamper the efficiency of the unit, but adequate safeguards and alternatives exist to insure the attainment of the unit mission.	1	0	1	2	4
2. Very Important. Failure to do this job properly will impair the efficiency of the unit, but the unit mission will probably be attained, even though more slowly or less accurately.	0	5	4	0	9
3. Extremely Important. Failure to do this job properly will seriously hamper the entire mission. It is certain that the mission will be attained either more slowly, less accurately, or not at all.	7	8	11	6	32
4. Critically Important. Failure to do this job properly will result in failure of the entire mission.	7	5	12	12	36
Total	15	18	28	20	81

Table 4

POTENTIAL CONSEQUENCES OF POOR MONITORING PERFORMANCE

Potential Consequences	Frequency of Responses				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
Delay or malfunction in launching missile, anti-missile missile or anti-aircraft missile	8	0	14	0	22
Personnel or equipment loss or damage (not a result of enemy action)	0	0	0	17	17
Delay or breakdown in communications and intelligence	1	0	8	2	11
Potential destruction or forced retreat of U S Army tactical units	0	10	0	0	10
Delay in detecting or tracking enemy aircraft or missiles	5	0	1	1	7
Inaccurately directing the aiming of heavy weapons	0	1	5	0	6
Possible destruction of US heavy tank artillery or armor	0	4	0	0	4
Delay in locating and firing on enemy positions	1	3	0	0	4
Total	15	18	28	20	81

Table 5

SOURCE OF SIGNALS MONITORED

Source of Signals	Number of Responses
Scopes only	9
Scopes plus allied displays	6
Terrain only	12
Terrain plus associated equipment	6
Instrument panels	31
Situational maps and plotting boards	5
Communications reception	6
Inspection or supervision	6
Total	81

TYPE OF SIGNAL

Respondents were asked to describe the specific "critical" signals associated with a given monitor task--those signals the observer is expected to watch for or listen for and then make appropriate response. Of all critical signals described by respondents, 68 percent were presented visually to monitors (Table 6). The major types of visual signal were: specified readings of meters, gauges, and dials; various types of scope-emitted signal; simple visual warning lights; and direct environmental sights associated with aggressor activity. Major types of auditory critical signals reported were: voice commands; simple auditory warning tones; and direct environmental noises associated with aggressor activity.

RECOVERABILITY OF SIGNALS--PACING OF TASK

Unless signals can be recorded in some way, the monitor can exercise no control over the speed at which he works, nor can he correct errors or omissions by rechecking. Table 7 shows that 65 out of 81 questionnaires reported monitor jobs in which the pacing of the task is imposed from without. Jobs in which the monitor can "recover" his critical signals--by playing back tape, for example--accounted for only 14 jobs, 10 of which were in the Technical Services, mainly reflecting inspection and laboratory jobs.

Table 6

DISTRIBUTION OF TYPES OF MONITORED CRITICAL SIGNAL

Visual Signals	Number of Jobs in Which Signal Occurs				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
Meters, gauges, dials--when reading is in critical region	4	0	14	10	28
Scope-emitted signals indicative of enemy activity, newly detected enemy positions, aircraft, etc.	15	0	7	1	23
Indicator lights signalling critical conditions	3	1	16	2	22
Identification and movement of enemy personnel and equipment	0	18	0	3	21
Printed material requiring response	0	1	6	3	10
Targets of visual aiming, sighting devices	0	1	4	2	7
Faulty equipment or supplies	0	0	0	5	5
Changes in chemical characteristics requiring corrective action	0	0	0	4	4
Situational maps and displays--variations or configurations requiring response	0	1	0	2	3
	22	22	47	32	123
Auditory Signals					
Voice commands requiring response	2	1	15	3	21
Noises created by the movement of enemy personnel and equipment	0	18	0	0	18
Indicator tones and alarms requiring response	4	1	5	5	15
Code characters	1	0	3	1	5
	7	20	23	9	59
Total	29	42	70	41	182

Table 7

PACING OF MONITOR TASK

	Number of Responses				
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	Total
Monitor paced	1	0	3	10	14
Pacing imposed from outside	14	18	24	9	65
Pacing sometimes imposed; sometimes subject to monitor control	0	0	1	1	2
Total	15	18	28	20	81

SIGNAL CHARACTERISTICS

Signal rate. It is a well documented fact that low signal rate is associated with low detection proficiency. Unfortunately, a questionnaire item on the frequency of appearance of critical and non-critical signals failed to elicit sufficient data. Most respondents claimed that signal rate was too variable to estimate. The information furnished on this item is presented in Table 8.

Duration of signal. Research has shown that, other things being equal, fewer detections are made in monitor tasks when signals are brief. As to the normal duration of signals for a given monitor task, most respondents were unable to estimate the specific duration of signals. The majority described signal duration as being variable. The meager results obtained are shown in Table 9.

Table 8

RATE OF APPEARANCE OF SIGNALS DURING EIGHT-HOUR SHIFT IN MONITOR JOBS

No. of Critical Signals	Number of Responses				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
5 or less	3	3	0	3	9
10-24	1	2	5	1	9
25-49	4	1	0	0	5
50-99	0	0	1	1	2
100 or over	0	0	1	3	4
Variable	5	12	19	6	42
Constant	0	0	0	4	4
Unknown - no response - inadequate response	2	0	2	2	6
Total	15	18	28	20	81
No. of Non-Critical Signals					
Under 20	2	2	1	0	5
20-100	2	3	1	1	7
100 and over	0	0	0	2	2
Variable	2	2	6	4	14
Constant	6	11	10	5	32
Unknown - no response - inadequate response	3	0	10	8	21
Total	15	18	28	20	81

Table 9

VARYING DURATION OF SIGNALS IN MONITOR JOBS

Critical Signals	Number of Responses				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
Less than 1 minute	3	6	1	1	11
1-5 minutes	0	0	1	0	1
10-30 minutes	4	0	2	2	8
Variable	5	1	15	6	27
Until detected	0	0	1	1	2
No reply or unknown	3	11	8	10	32
Total	15	18	28	20	81
Non-Critical Signals					
Less than 1 minute	0	1	0	0	1
1-5 minutes	0	5	1	0	6
10-30 minutes	0	0	1	0	1
Variable	4	1	5	1	11
Constant	8	10	12	9	39
No reply	3	1	9	10	23
Total	15	18	28	20	81

Regularity of signal occurrence. Respondents were asked for estimates of the regularity with which signals occur. Research has shown that, other things being equal, irregular signals are less efficiently detected than are regular signals. Table 10 shows that, while most respondents were unable to designate a quantitative pattern of occurrence, critical signals occurred irregularly in 69 percent of the monitor jobs described. Non-critical signals appeared continuously in the case of a majority of the jobs described.

Work-rest schedules. Since length of vigil has a major influence on detection proficiency of monitors, several questions were asked with reference to work and rest schedules. Table 11 summarizes the results with respect to duration of the usual period of monitoring. For radar operators, scan periods varied from as low as ten minutes to as high as two hours. The questions did not apply to terrain monitors, most of whom are combat soldiers. Most equipment monitors, both in the Combat Arms and the Technical Services, monitored in intervals ranging from 50 minutes to two hours. The most frequent work periods for all types of monitor task were 50 minutes and two hours.

Another item requested information on the length of rest breaks interspersed with monitoring periods. Table 12 shows that ten minutes was by far the most frequent rest period in those jobs in which rest periods were systematically scheduled. Thirty-one questionnaires reported length of the rest period as "variable." This lack of systematic scheduling was less surprising for the 13 terrain monitor jobs than for the 17 equipment monitor jobs. Other than "10 minutes" and "variable," rest periods ranging from 15 minutes to as long as two hours were reported in the case of 25 monitor jobs.

An allied question was the number of rest periods during a normal eight-hour shift. Results are shown in Table 13. Again, many questionnaires (34) reported no systematic number of rest periods. When a schedule of rest periods was reported, the range was wide--from only 2 per day to as high as 16 per day. Variation was also wide within different monitoring categories. For radar monitoring, rest periods ranged from 2 to 16 per day; for equipment monitoring the range was from 2 to 7 per day.

Table 10

REGULARITY OF SIGNALS IN MONITOR JOBS

Critical Signals	Number of Responses				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
Variable	9	13	19	15	56
Approximately every 5 seconds	0	0	0	1	1
Approximately every 12 minutes	1	0	0	1	2
Approximately every 16 minutes	0	0	1	0	1
Approximately every 20 minutes	0	0	2	0	2
Approximately every 45 minutes	0	2	0	0	2
Approximately every 2 hours	1	3	0	0	4
Approximately one per shift	3	0	0	0	3
As often as weapon fires	1	0	2	0	3
No response - unknown - inadequate response	0	0	2	1	3
Continuously	0	0	2	2	4
Total	15	18	28	20	81
Non-Critical Signals					
Variable	8	2	5	1	16
Approximately every 20 minutes	0	0	1	0	1
Approximately every 45 minutes	0	3	0	0	3
Every 2 hours	1	2	0	0	3
Every 8 hours	1	0	0	0	1
Constant-continuous	5	11	11	10	37
No response - unknown - inadequate response	0	0	11	9	20
Total	15	18	28	20	81

Table 11

LENGTH OF USUAL WORK PERIOD IN MONITOR JOBS

Work Period	Number of Responses				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
10 minutes	1	0	0	0	1
30 minutes	4	0	0	0	4
50 minutes	5	0	6	5	16
1 hour	1	0	1	0	2
1 1/2 hours	0	3	0	1	4
2 hours	3	2	5	4	14
4 hours	0	0	0	2	2
Continuous in combat	0	11	8	0	19
Variable - non-scheduled	1	0	0	1	2
Classified	0	0	4	0	4
Unusable reply	0	2	4	7	13
Total	15	18	28	20	81

Table 12

LENGTH OF REST PERIODS IN MONITOR JOBS

Rest Period	Number of Responses				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
10 minutes	6	0	8	7	21
15 minutes	0	2	1	3	6
20 minutes	2	0	2	2	6
30 minutes	1	3	0	1	5
1 hour	1	0	0	1	2
2 hours	4	0	2	0	6
Variable	1	13	11	6	31
Classified	0	0	4	0	4
Total	15	18	28	20	81

Table 13

NUMBER OF REST PERIODS DURING AN EIGHT-HOUR SHIFT IN MONITOR JOBS

Rest Period	Number of Responses				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
2	3	0	2	5	10
3	3	3	0	0	6
4	1	0	3	1	5
5	0	2	0	0	2
6	3	0	0	5	8
7	2	0	6	1	9
8	2	0	0	0	2
16	1	0	0	0	1
Variable-unscheduled	0	13	13	8	34
Classified	0	0	4	0	4
Total	15	18	28	20	81

NON-MONITORING TASKS PERFORMED BY MONITORS

A factor sometimes overlooked in vigilance research is that monitors in operational settings usually have duties other than observational duties. Since there is some evidence to suggest that the amount of parallel or interpolated activity on the part of the monitor may influence detection performance, information was requested on the nature of the non-monitor activity and the amount of time spent in non-monitor duties. Checking, cleaning, and adjusting of apparatus and weapons constituted the non-monitor aspects of the largest number of the jobs described (Table 14). The second most frequent non-monitor activity was "performs manual labor."

While no particular pattern of non-monitoring activity emerged from the data, it is clear that all monitors represented in the jobs described perform non-monitor duties.

Table 14

NON-MONITOR TASKS PERFORMED BY INCUMBENTS OF MONITOR JOBS

Activity	No. of Jobs in which Non-Monitor Tasks are Performed				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
Checks, adjusts and cleans equipment	12	9	13	8	42
Performs manual labor	0	9	7	6	22
Writes reports or keeps logs	3	0	3	13	19
Manipulates instruments	8	2	2	7	19
Relays information verbally	3	9	3	2	17
Calculates, measures or plots data	3	1	5	6	15
Fires weapon	0	8	3	0	11
Trains or supervises personnel	1	4	1	3	9
Makes procedural or time checks	1	0	1	1	3
Total	31	42	38	46	157

Respondents were also asked to estimate the percentage of time spent in monitor and in non-monitor activity. For 67 percent of the jobs reported, monitoring duties alone were estimated to require 50 percent or more of operator time. In 94 percent of the jobs, monitor duties required 20 percent or more of operator time (Table 15). Returns indicated that Technical Services equipment monitors spend relatively the highest percentage of time in purely observational duties.

Table 15

ESTIMATED PERCENTAGE TIME SPENT MONITORING BY INCUMBENTS OF MONITOR JOBS

Percentage of Time Monitoring	Number of Responses				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
90 and above	2	0	3	4	9
80-89	3	1	4	3	11
70-79	1	1	4	5	11
60-69	1	7	3	2	13
50-59	0	6	2	2	10
40-49	0	0	1	2	3
30-39	1	3	3	0	7
20-29	5	0	6	1	12
10-19	2	0	2	0	4
under 10	0	0	0	1	1
Total	15	18	28	20	81

CHECKS ON MONITORING ACCURACY

The seriousness of the monitor's initial failure to detect critical signals is determined to a great extent by the checks on the accuracy of detection built into the monitor system. Although it was not feasible to attempt an evaluation of checking methods by means of the questionnaires, it was possible to inventory some of the commonly used accuracy checks

(Table 16). By far the most common method reported was supervision (46%). In fact, the use of supervision was reported for all types of monitor job. Most questionnaires reported periodic supervision; a smaller number reported continuous supervision. Another accuracy check used frequently is to assign more than one monitor to the same task. Other highly standardized routines were reported.

HUMAN FACTORS PROBLEMS IN MONITOR JOBS

Questionnaire respondents were asked to list any particularly disturbing or annoying conditions that might affect performance on the monitor job under normal operating conditions. For radar and equipment monitors, the problems most frequently mentioned included fatigue, harassing noise levels, crowded work areas and restricted physical positions, weather extremes, and stress induced by fear of enemy action (Table 17). For respondents describing terrain monitor jobs, "normal operating conditions" were combat conditions.

HUMAN FACTORS PROBLEMS ANTICIPATED IN MONITOR JOBS UNDER COMBAT CONDITIONS

Questionnaire respondents were also asked to list any significant changes that might be expected if the monitor job were performed under combat rather than normal conditions. The problems cited (Table 18) are similar to those reported as now existing (Table 17), partly because for terrain monitors anticipated problems were seen as identical to normal operating problems. The relative frequency with which certain conditions were mentioned did change, however. As expected, stress brought about by enemy activity and the fear of such activity took first place in anticipated problems, particularly among terrain monitors. Still mentioned frequently were problems of long and irregular working hours, higher workload, and fatigue. Also included were intensified physical discomfort and job-induced stress caused by tighter work deadlines. The Technical Services, as was expected, anticipated few significant changes under combat, since the majority of their jobs are support activities which would change less as a result of mobilization.

Table 16

METHODS OF CHECKING ON MONITOR ACCURACY

Method	No. of Jobs in Which Method is Used				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
Supervision - Continuous	0	12	7	2	21
Supervision - Periodic	8	10	16	7	41
Multiple monitors	3	13	9	7	32
Multiple detection systems	4	0	2	1	7
Highly standardized procedures	2	2	7	5	16
Signal information recoverable	0	0	0	4	4
Automatic signal devices (alarms) when signal missed	0	0	0	3	3
Training	4	0	0	0	4
Artificial testing period	1	0	0	0	1
Multiple types of detection devices	0	0	2	1	3
No response--not applicable	0	0	3	0	3
Total	22	37	46	30	135

Table 17

DISTRIBUTION OF HUMAN FACTORS PROBLEMS ASSOCIATED WITH MONITOR JOBS

Existing Problems	No. of Jobs in Which Problems Occur				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
Long working hours or fatigue	10	6	13	5	34
Harrassing extraneous signals - audio	7	1	11	15	34
Crowded work area or restricted position	6	11	5	4	26
Weather extremes	4	7	7	6	24
Fear of enemy action	2	13	7	0	22
Poor illumination and visibility	6	2	4	3	15
Working under tight deadlines	2	0	3	4	9
Physical hardships	0	0	8	0	8
Communication failure	0	4	3	0	7
Night work	3	0	3	1	7
Isolation	3	0	2	1	6
Repetitive, routinized procedures	1	0	2	2	5
Harrassing extraneous signals - visual	3	0	2	0	5
Signal overloads	2	0	1	0	3
Enemy jamming	2	0	0	0	2
Lulling effect of signals	1	0	0	0	1
Total	52	44	71	41	208

Table 18

NUMBER OF JOBS IN WHICH ADDITIONAL PROBLEMS WOULD BE EXPECTED UNDER COMBAT CONDITIONS

Anticipated Problems	Distribution of Jobs				Total
	Radar Monitoring	Combat Arms Terrain Monitoring	Equipment Monitoring	Technical Services Equipment Monitoring	
Fear of enemy activity	1	14	7	0	22
Harrassment or direct fire from the enemy	2	14	6	0	22
Greater likelihood of fatigue	4	8	5	2	19
Longer or irregular working hours	5	2	8	1	16
Increased work load or more dense signal environment	3	3	5	1	12
Intensified physical discomfort	0	5	5	0	10
Working under tight deadlines and strict controls	2	0	5	1	8
More work per person	5	0	2	0	7
Less supervision possible	2	0	0	0	2
Frequent equipment or position moves	1	0	0	0	1
Enemy jamming	1	0	0	0	1
Total	26	46	43	5	120

SUMMARY OF SURVEY FINDINGS

1. From a total of 1528 duty positions examined, 102 were designated by operational personnel as having a sufficiently heavy proportion of monitor duties to be considered "vigilance" jobs. In these 102 monitor jobs, 47 independent MOS were represented.

2. Eight-four percent of the monitor jobs reported were rated as critically or extremely important to the achievement of unit missions. The high degree of importance attached to these monitor jobs stems from the actual or anticipated consequences of poor performance.

3. More monitor jobs were reported by the combat arms (72 duty positions) than by the technical services (30 duty positions).

4. Equipment monitoring accounted for 64 of the 102 jobs; terrain and radar monitors for 22 and 16 positions respectively.

5. A number of factors likely to affect monitor output and dependability were outlined from responses to specific questions. Examples: varying sense modalities and characteristics of the signal, length of work-rest periods, non-monitor duties performed, degree of control monitor can exercise over rate of signals, recoverability of signals, conditions of workload, fatigue, and stress, methods of checking accuracy of product. Variations in these and other dimensions of monitor activity which emerged from the survey offer material for possible research approaches to increased dependability of monitor systems output.

CONCLUSIONS

1. Over 100 duty positions in the present Army are considered to be wholly, or in substantial part, vigilance jobs. These jobs are found within all of the Combat Arms and in most of the Technical Services. The number of monitor jobs will in all likelihood increase in the future, both in number and diversity, with the introduction of new weapons and surveillance systems.

2. The high degree of importance attached to monitor jobs by operational personnel, along with the potentially serious consequences of poor monitor performance, confirms the initial judgment of the U. S. Army Personnel Research Office that a long-range research program in monitor problems is justified and important.

3. Many of the characteristics of monitor jobs lend themselves to a human factors research approach and will be incorporated in future USAPRO efforts. Present Army monitor jobs involve predominantly the visual monitoring of display panels, scopes, and terrain. Signal parameters, work cycles, and administrative practices were reported as highly variable. Present and anticipated human factors problems include fatigue and stress states and various environmental restrictions.

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APPENDIX A

VIGILANCE JOB QUESTIONNAIRE

Reports Control Symbol AG-(OT)-428

MOS _____ JOB POSITION TITLE _____

*Note: Attach an extra sheet when more space is needed to answer questions

1. WHAT IS OBSERVED:

   a. _____

   b. Task is: Self-Paced ☐ Not Self-Paced ☐

2. DESCRIBE THE SIGNALS:

   a. Critical: _____

   b. Non-Critical: _____

   c. Signals are: Audio ☐ Visual ☐ Both ☐ Other ☐ (Explain) _____

3. HOW OFTEN DO THE SIGNALS APPEAR: (During an 8-hour period)

   a. Critical:

      (1) Minimum _____ Normal _____ Maximum _____

      (2) Length of time critical signal stays on (duration): _____

   b. Non-Critical:

      (1) Minimum _____ Normal _____ Maximum _____

      (2) Length of time non-critical signal stays on (duration): _____

4. HOW REGULARLY DO THE SIGNALS APPEAR? (During an 8-hour period)

   a. Critical: _____

   b. Non-Critical: _____

5. WHAT IS THE LENGTH OF THE USUAL WORK PERIOD?

   a. _____

   b. Length of usual rest periods _____

   c. How many rest periods (8-hour period) _____

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TURN THIS SIDE OVER

6. WHAT OTHER TASK DOES THE OBSERVER PERFORM?

a. _____

b. Estimate percentage of time spent (8-hour period):

(1) Observing ___% (2) Doing other things___% (1 + 2 = 100%)

7. WHAT CHECKS EXISTS ON THE DETECTION ACCURACY OF THE OBSERVER?

8. WHAT HAPPENS WHEN?

a. The Observer detects a critical signal?

b. The Observer fails to detect a critical signal?

9. DESCRIBE ANY PARTICULARLY DISTURBING OR ANNOYING CONDITIONS THAT MIGHT AFFECT PERFORMANCE ON THIS TASK.

10. DESCRIBE ANY SIGNIFICANT CHANGES WHICH MIGHT OCCUR AS A RESULT OF THIS TASK BEING CARRIED OUT UNDER COMBAT CONDITIONS.

11. OVER-ALL RATING OF THE IMPORTANCE OF THIS JOB IN ATTAINING THE MISSION OF THE IMMEDIATE UNIT OF WHICH IT IS A PART: (Check One)

Fairly Important	Very Important	Extremely Important	Critically Important
Failure to do this job properly might slow down or hamper the efficiency of the unit, but adequate safeguards and alternatives exists to insure the attainment of the unit mission.	Failure to do this job properly will impair the efficiency of the unit, but the unit mission will probably be attained, even though more slowly or less accurately.	Failure to do this job properly will seriously hamper the entire mission. It is certain that the mission will be attained either more slowly, less accurately, or not at all.	Failure to do this job properly will result in failure of the entire mission.

Signature of Person Completing Questionnaire: _____

Title: _____

Grade: _____

Organization: _____

APPENDIX B

Reports Control Symbol AG-(OT)-428

INSTRUCTIONS FOR COMPLETING
THE VIGILANCE JOB QUESTIONNAIRE
AGTZ Form 73

Department of the Army

1961

INSTRUCTIONS FOR COMPLETING VIGILANCE JOB QUESTIONNAIRE, AGTZ Form 73

I. SELECTING JOBS WHICH REQUIRE VIGILANCE

To complete this survey it is necessary to go through two basic steps. First, personnel with knowledge of the specific jobs should read the attached LIST OF JOB POSITIONS and select those jobs requiring vigilance. It may be helpful to simply line through those jobs which do not require vigilance. Questionnaires should be completed only for those which do require vigilance. Following are a definition of vigilance, examples of vigilance jobs, and guidelines for helping make these selections.

A. Definition of Vigilance

What constitutes a vigilance job? Vigilance is defined as the process of paying sustained attention to some task over a relatively prolonged period of time. Typically, the observer is confronted with a series of signals (visual or auditory) to which he must pay attention in order to detect a particular type or class of signal. Those signals requiring the observer to respond are called critical signals. The highly vigilant observer, then, is one who detects all of the critical signals appearing to him over a period of time.

B. Some Examples of Vigilance Jobs

(1) Apparatus monitoring constitutes one class of vigilance tasks. The radar operator is a frequently cited example. This individual (e.g., air surveillance system) must pay sustained attention to his viewing scope over a prolonged period of time. He receives a series of signals in the form of visual traces on the face of the scope. He must be sufficiently alert to detect and respond to the critical signals ("blips" representing aircraft) and at the same time not respond to the non-critical signals, ("blips" representing clouds, flocks of birds, "ghosts", etc.).

(2) Auditory tasks may also require vigilance. For instance, a radio voice interceptor may be required to listen over a prolonged period of time. He receives a series of signals in the form of sound waves. He must be sufficiently alert to detect and respond to the critical signals (e.g., certain call signs) and at the same time not respond to non-critical signals (e.g., other call signs monitored by other interceptors).

(3) Another example of a vigilance task is that of an inspector. For instance, an inspector may be required to observe a series of objects (e.g., assembly line) over a prolonged period of time. He receives a series of signals in the form of visual impressions. He must be sufficiently alert to detect and respond to critical signals (e.g., defective items) and at the same time not respond to non-critical signals (acceptable items).

(4) Free search monitoring constitutes another class of vigilance task. For example, a forward artillery observer must pay sustained attention to a sector of terrain over a prolonged period of time. He

receives a series of signals in the form of environmental visual impressions. He must be sufficiently alert to detect and respond to critical signals (aggressor personnel and material) and at the same time not respond to the non-critical signals (trees, rocks, friendly personnel, etc.).

C. Criteria for Selecting Vigilance Jobs

With the preceding definition and examples in mind, the nature of vigilance jobs should become clearer. Following are four specific criteria which are designed to aid further those involved in the selection of vigilance jobs:

(1) The job must require the observer to pay sustained attention over a relatively prolonged period of time. No task should be considered a vigilance task unless a minimum of 30 minutes continuous observation time is required.

(2) The job must require the observer to select out certain signals (critical) from other signals (non-critical) which are not important for or relevant to the particular task. Critical signals are simply what the observer is supposed to be looking for or listening to. Non-critical signals may be electronically generated blips, background noise, terrain features . . . . in short, anything which the observer is likely to come in contact with, but which does not require a report or a response.

(3) There are no restrictions on what is observed. The job may require the observation of equipment, instrument panels, machines, terrain, sky or people. Signals received may be visual, auditory, or even tactual.

(4) The job may require the individual to do things other than observe. For instance, he may be required to manipulate simultaneously switches or knobs, make computations, record information, use a telephone, or fire a rifle.

Should there be doubt as to certain positions meeting the vigilance criteria, it is suggested that more than one military specialist review the job independently, and then check results with each other. Agreement on the final list should be reached.

II. COMPLETING THE VIGILANCE QUESTIONNAIRE

After the final list of vigilance jobs has been selected, it is necessary that a questionnaire containing eleven specific questions be answered about each position. Questionnaires are not requested for jobs which do not require vigilance. The following section is designed to further explain and define each questionnaire item:

Question No. 1: What is observed: This question calls for a brief description of the apparatus, scenery, or other objects which the observer looks at or listens to. If the object observed is an apparatus, give the

full nomenclature. If terrain or air is observed, indicate what general scope of observation ordinarily is required, e.g., "three hundred yards to the front", or "as far as he can see".

Also indicate by a check-mark whether the observing process is self-paced. That is, can the observer set his own pace of work? Radar operation, for instance, is not a self-paced task. The observer cannot control the rate of signal appearance. Other apparatus monitors, however, such as teletype receivers, can scan their tapes at any rate desired. Thus, their critical signals may be recovered. Free search observers will rarely have self-paced jobs. Sentries and forward artillery observers, for example, do not control the rate at which signals appear, that is, they can neither "turn-off" nor recover environmental signals.

Question No. 2: Describe the Signals: Under "Critical" describe just what it is that the observer is supposed to look or listen for . . . whether it is enemy targets, signals on a scope, dials, lights, buzzers, or a danger zone on an inspection instrument. Under "non-critical", describe just what it is that the observer will likely see or hear, but which he will not have to respond to. These may include such signals as friendly troops, static, ghost images, and so forth. Indicate by check whether the signals are auditory, visual, both, or other.

Question No. 3: How Often do the Signals Appear: Indicate, under the normal operating conditions for this job, how often the critical and non-critical signals usually appear during an 8-hour period. If the signals appear only during combat conditions, so indicate, then give an educated guess on how often they would appear during combat.

In the appropriate space estimate the minimum, normal, and maximum number of signals during an 8-hour working period.

Also indicate, in the spaces shown, how long the critical and non-critical signals may be expected to stay on. If this is variable, give the normal range.

Question No. 4: How Regularly Do the Signals Appear: Describe, under the normal operating conditions for this job, patterns of reappearance of the signals, that is, does the second signal ordinarily follow 30 minutes behind the first and the third 30 minutes behind the second? Or might one typically expect 10 signals in one hour and none for the next seven hours?

Question No. 5: What is the Length of the Usual Work Period: Under normal operating conditions for this job, how long is the observer typically required to observe without an authorized break or rest period? If the work periods are variable, give the normal range.

Also indicate in the appropriate space, the length of the usual rest periods between observing periods. Also indicate how many rest periods are authorized during an 8-hour observation period.

Question No. 6: What Other Tasks Does the Observer Perform: Very few jobs are "pure" vigilance tasks...in which the observer does nothing but look or listen. In addition to observing, he may be required, for example, to prepare reports, manipulate instruments or communicate with others. Briefly describe the other duties which the observer must perform during a normal working period.

Also estimate, in the appropriate spaces, the percentages of time the observer spends strictly in observation and how much is spent in other duties during the course of a normal 8-hour period.

Question No. 7: What Checks Exist on the Detection Accuracy of the Observer: Describe any checks built into the observing process to augment the accuracy of the observer in detecting the critical signal. As examples, the checks may be in the form of frequent supervision, apparatus checks--such as recoverable tapes and photos of signals, or dual observers with responsibility for the same job.

Question No. 8: What Happens When:

a. The Observer detects a critical signal? Explain just what it is that the observer is supposed to do when he detects a critical signal. As examples, he may merely record the occurrence on a report form, verbally inform a superior, make an adjustment by means of a knob or switch, or call for artillery fire.

b. The Observer fails to detect a critical signal: Explain the consequences of missing a critical signal. Indicate or estimate the least serious consequence that might result from such a lapse, and indicate the most serious consequence that might result.

Question No. 9: Describe any Particularly Disturbing or Annoying Conditions That Might Affect Performance on This Task: Indicate those conditions which, under normal operating conditions, might detrimentally affect performance on the job. List both those conditions which are usually present and also those which are only infrequently encountered. Examples of "disturbing or annoying" conditions are: having to work night shifts, having to work under poor conditions of illumination, having to sit in restricted positions for a long time, having to work very rapidly and under pressure, having to work with inadequate equipment, having to work under conditions of extreme noise, heat, cold, isolation, work overloads, long shifts, fatigue, or any form of psychological harassment. One source of information for answering this question are the most common complaints of the men who fill the jobs.

Question No. 10: Describe Any Significant Changes Which Might Occur as a Result of the Duties of This Position Being Carried Out Under Combat Conditions: Some educated guessing will possibly be necessary to answer this question. Describe changes in job content which might occur either in a traditional war or on a nuclear battle field--other than the obvious change that personal danger is much greater in combat. Examples of possible

changes are: critical signals might appear at much higher or lower rates, signals might increase or decrease in regularity; the environmental background--non-critical signals--might be radically changed; the non-observing portions of the job might be different; accuracy checks might become more or less stringent; a greater or lesser number of observers might be used for the same task; the observer's response on detecting a signal might change; and the consequences of a missed critical signal might change. Differences in working periods, isolation, and the noise levels are also examples.

Question No. 11: Over-all Rating of the Importance of This Job in Attaining the Mission of the Immediate Unit of Which it is a Part: Select one of the four options which most nearly represents your estimation of the importance of this job. If the job is primarily a combat job, then estimate its worth under combat conditions. If, on the other hand, the job is primarily a non-combat job, estimate its worth under non-combat conditions. The mission refers to the immediate mission of the smallest functional unit to which the job belongs. For example, infantry squad, fire control section of a missile system, radar team in an early warning system, and so forth.

APPENDIX C

U. S. ARMY DUTY POSITIONS
REPORTED AS HAVING A SUBSTANTIAL VIGILANCE COMPONENT

I. VISUAL AND AUDIO-VISUAL MONITORING POSITIONS

A. RADAR MONITORS

Armor Crewman:	131.4 Radar Operator 131.4 Sr. Radar Operator
Armor Intelligence Specialist:	133.4 Radar Operator 133.4 Radar Operator
FA Radar Crewman:	156.1 Radar Operator 156.7 Platoon Sergeant
AD Missile FC Crewman (Hawk):	176.1 FC Operator 176.0 Azimuth Speed Operator
AD Fire Distribution Systems Crewman:	186.1 Fire Distribution Crewman
AD Missile Cont Wave R Mech (Hawk):	221.1 Cont Wave Radar Mech
AD Missile FC Mech (Hawk):	228.6 FC Mechanic
AD Missile FC Crewman (Nike Ajax):	173.1 MTR Operator 173.1 ACQ Radar Operator 173.1 TTR Operator
AD Missile FC Crewman (Hawk):	176.1 Tactical Control Asst
AD FC Crewman (Nike Hercules):	179.1 FC Crewman
Defense ACQ Radar Crewman:	181.1 ACQ Radar Crewman
Heavy AD Arty FC Crewman:	193.1 Sr. Radar Operator

B. TERRAIN MONITORS

Armor Intelligence Specialist:	133.0 Scout 133.6 Scout Leader
Flash Ranging Crewman:	154.0 Flash Operator 154.1 Flash Observer

Sound Ranging Crewman:	155.0 Sound Observer 155.1 Sound Recorder 155.2 Sound Crewman
Light Weapons Infantryman:	111.0 Asst Auto Rifleman 111.0 Asst Gunner 111.0 Rifleman 111.1 Gunner 111.1 Auto Rifleman 111.1 Sr. Rifleman 111.6 Squad Leader 111.6 Fire Team Leader
Heavy Weapons Infantryman:	112.1 Gunner (Direct Fire) 112.3 Survey Specialist 112.6 Forward Observer
Armor Crewman:	131.2 Gunner 131.6 Tank Commander 131.6 Section Leader 131.7 Platoon Sergeant

C. EQUIPMENT MONITORS (COMBAT ARMS)

Heavy Weapons Infantryman:	112.1 Instrument Operator 112.1 Horizontal Control Operator 112.2 Fire Direction Computer 112.6 Chief Fire Direction Computer
Armor Crewman:	131.3 Oper Specialist
FA Missile (Corporal):	164.3 Mech Materiel Specialist
FA Missile FC Crewman (Corporal):	165.1 FC Crewman
FA Missile Crewman (Redstone):	168.1 Launcher Crewman
FA Missile Materiel Crewman (Redstone)	169.1 Propulsion Specialist
AD Missile FC Crewman (Hawk):	176.1 FC Operator
AD Missile Crewman (Nike Hercules):	177.1 Nike Univ Launcher Crewman
FA Missile Electronics Mechanic (Corporal):	214.3 Materiel Maint Spec

FA Missile FC Mechanic (Corporal):	215.1 FC Mechanic
AD Missile Mechanic (Hawk):	227.1 Missile Mechanic
Switchboard Operator:	724.1 Telephone Switchboard Operator 724.1 Sr. Telephone Switchboard Operator 724.6 Chief Operator
Heavy Weapons Infantryman:	112.1 Gunner (Indir Fire)
AD Missile Crewman (Nike Ajax):	171.1 Launch Control Console Operator 171.1 SOC-1 Operator
FA Missile Electronics Mechanic (Redstone):	218.1 Electronic Materiel Spec
AD Missile Mechanic (Hawk):	227.1 Missile Mechanic 227.6 Assembly Sergeant 227.7 Shop Foreman
Teletype Operator	723.1 Teletypewriter Operator

D. EQUIPMENT MONITORS (TECHNICAL SERVICES)

Countermeasures Search Specialist:	204.1 Search Specialist
Nuclear Power Plant Operator:	358.1 Operators 358.2 Operators 358.3 Operators 358.4 Operators 358.7 Shift Superintendent
Harbor Craft Boatswain:	562.6 Harbor Craft Operator 562.7 Boatswain
Marine Engineer:	565.2 Marine Engineer Repairman 565.6 Marine Engineer Repair Foreman 565.7 Marine Engineer Repair Foreman
Offset Pressman:	835.1 Offset Pressman 835.2 Sr. Offset Pressman

Parachute Rigger:	464.1 Parachute Packer 464.1 Sr. Parachute Packer 464.6 Air Del Equipment Specialist 464.6 Procurement Acceptance Inspector 464.7 Parachute Packer Supervisor
Duty Soldier (QMG):	540.0 Sol Tank Operator
Industrial Crane Operator:	561.1 Crane Operator
Oxygen-Acetylane Production Specialist:	571.1 Oxygen-Acetylane Plant Operator
Carbon Dioxide-Hydrogen Production Specialist:	572.1 Carbon Dioxide Plant Operator
Liquid Oxygen-Nitrogen Production Specialist:	573.1 Plant Operator
Boilermaker:	654.1 Boiler Repairman 654.7 Boiler Inspector
Map Compiler:	812.2 Map Compiler
Topographic Surveyor:	822.2 Geodetic Surveyor
Petroleum Laboratory Specialist:	903.1 Laboratory Specialist 903.1 Sr. Laboratory Specialist
Medical Specialist:	911.3 Open-heart Machine Operator

II. AUDITORY MONITORING POSITIONS

Low Speed Radio Operator:	050.0 Low Speed Radio Operator
Radio Operator:	051.1 Intermediate Speed Radio Operator 051.6 Chief Radio Operator
Light Weapons Infantryman:	111.0 Radio Telephone Operator
Heavy Weapons Infantryman:	112.0 Radio Telephone Operator E3
AD Missile Crewman (Hawk):	174.1 Launcher Crewman
Countermeasure Search Specialist:	204.1 Specialist
Radio Teletype Operator:	053.1 Radio Teletype Operator 053.6 Radio Teletype Team Chief